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Utilization of Poultry Skin as One of the Components for Emulsion-Based Products

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Abstract: An study considers the questions of importance of emulsion-based products, used as therapeutic, dietary products and as products for mass consumption. Carried out tests speak about expediency of use of some secondary product of meat processing in particular of chicken skin in meat production. Data of the determined chemical composition allow drawing a conclusion on sufficient nutritional value of the chosen research objects. It is good opportunity to use chosen low-value collagen-containing products of poultry in production of new meat products in food industry in the Republic of Kazakhstan.

Key words: Emulsion-based products, secondary product of meat processing, collagen-containing products of poultry, data, skin

INTRODUCTION

Development of emulsion-based products to be used as therapeutic, dietary products and as products for mass consumption is the current priority of food industry in the Republic of Kazakhstan. It is necessary and important to provide low-caloric food products with the same organoleptical properties as traditional food products. To saturate mass market with such emulsion-type products it is necessary to improve their diversity in terms of taste properties, fat acidity value, amino-acidic, carbohydrate and micro nutritional balance.

While developing formulas for emulsion-type products it is necessary to make sure they have stable content, microbiology, taste and aroma while stored. Therefore, it is important to select ingredients in such way that they will not interact between each other and will preserve the qualities of the original product. Let us analyze several research projects accomplished in the field of development of emulsion-type products and their use.

MATERIALS AND METHODS

Objects and methods of the research: Researchers Voskanyan and Shlenskaya (2004) from Moscow State University of Technology and Management developed emulsion product, enriched with biologically active ginseng, in the form of 40% alcohol water mixture. It was established that enrichment of food products in particular, fat emulsion-type products with ginseng allows improving nutritional as well as biological value increase variety and quality of the products. Besides, adding ginseng to the formula in the amount of 0.2-4 mL L^{-1} helps to improve physical, chemical parameters, rheological behavior and organoleptical properties also, it allows boosting durability and acidity of the freshly made and pre-stored products.

Popular emulsion-type products for enteral feeding, Ovolakt and Compozit were developed in late 80's Ovolakt was developed for feeding patients with various health issues surgical, cancer, burns etc. This product is presented in the form of dried emulsion which can be easily rehydrated when mixed with water of any temperature. The protein component of the product is made of milk and egg proteins, carbohydrate spectrum of the product is made of starch hydrolysate, lipids are sourced from thoroughly emulsified vegetable oil.

Kompozit is made in the form of ready-for-use emulsion for enteral feeding. It is also nutritionally balanced and has high value of dietary fiber (Tokaev and Rogor, 1998).

Emulsion made of chicken, glucose, soy flour, water, fat, potassium sorbate, propylene glycol and emulsifier is recommended for feeding children. According to the

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research team of Alekseev *et al.* (2008) from the department of applied biotechnology, Moscow State University (research base-sausage factory "Vostryakovo 2"), sausage products which are part of school menu, enriched with vitamins are highly efficient for prophylactics of polyhypoavitaminosis among children. Red palm oil "Carotino" was used as primary source of vitamins here. For the purpose of enrichment with vitamins it was added to the sausage ground meat in the form of fat emulsion.

Mixtures for general nutrition, such as "Ensure", "Fresubin", "Nutricomp" and others, are made in the form of ready-to-be-used emulsions or in the form of powder. These food products are nutritionally well-balanced. Albuminous nitrogen is carried by milk and soy proteins, in some cases specific amino acids are added as well;carbohydrates are provided by partially saccharified starch and lipids are sourced from vegetable oil. The caloric content of these food products is 1 mL 2.09-8.6 J. Caloric balance amounts to 15-18% for proteins, 24-34% for fat, 48-59% for carbohydrates. These emulsions have stable content and high dispersion, low viscosity and pleasant taste; they are being taken in orally (Tokaev and Rogov, 1988).

Research team from North-Caucaus State Technological University developed a food emulsion, whichis used as nutritional supplement for variety of meat products. It is comprised of alimentary blood (55%), vegetable albumen (8-12%), milk protein (2-4%), bone oil (10-15%), chitosan (0.1-0.25%) and water; also starch and gelatine to act as emulsifier and gelatinizing agent.

American researchers Dingman *et al.* (2005) created meat emulsion product. It is made of multiple fibre sources, formed into one mass which contains at least 29% of protein and maximum 7% of fat. This invention allows creating food products very close to meat.

Under supervision of E.T. Tuleuov, researchers from Shakarim State University of Semey developed various emulsion-type protein enrichers, primarily made from alimentary horse blood, blood plasma and various sub-products.

Now a days emulsions are becoming more popular in terms of using them as part of nutrition directly or as a basis for more complex food products. The reason to that is the possibility to include all the necessary nutritional and biologically active components in the content of emulsion, also it allows to add lipids in the digestible form. Emulsions are flexible in terms of content and sourcing, therefore, it is easy to create products of various rheological behaviors, from liquid to solid and to create food products of different structural form.

In this regard poultry low-value after products as well as industrial waste have not been studied thoroughly yet. Still, it is well known that low-in-value parts, such as head, feet, neck, etc., are recommended for further use in soup sets and jellied meat; however, these food products are not popular among consumers, also they have short term storage life. Hence, factories have to utilize these parts as protein sources for cattle feed. At present, for every 1000 tons of eviscerated poultry there are 138.5 tons of low-value after products or 273.5 tons after more complex processing.It comprises about 12% of processing mass, containing 18-24% protein value from total.

The following histomorphologic and chemical analysis was conducted in order to better evaluate the feasibility of using low-value after products, in particular poultry skin, for emulsion-type food products.

Hystologically poultry derma is made of two layers, top layer and inner layer. The top layer is made of collagen fibers which are arranged in tiny clusters and with multiple blood vessels. The inner layer is made of thick clusters of collagen fibers.The fibers are laid in the direction parallel with the skin surface; it has high fat content (up to 20%) and large sub-layers of cellular tissue.

The high component of collagen fiber determines structural and mechanical properties of poultry skin, it can be also used for nutritional and medicinal purposes; as nutritional fiber, collagen adds to medical and preventive value of the food product. Protein components extracted from connective tissue enrich food products with dietary fiber, support human digestive function and help it to eliminate waste.

However, insufficient research hinders application of the knowledge towards improvement and further development of after products processing in poultry industry. In this regard the following analysis has been done to study general chemical structure of poultry skin. For this purpose fresh poultry skin samples were selected and tested under general standard methods.

Researches on determination of the chemical composition of a chicken skin were conducted on the basis of Shakarim State University of Semey laboratory. Determination of the chemical composition gives the chance to gain an impression about quality of raw materials and created product, depending on a quantitative ratio of moisture, protein, fat and also mineral substances. Determination of a mass fraction of moisture was determined by a drying method to constant weight at a temperature of 103-1050°C (State Standard 17671-82-77);

Table 1: Structure of poultry skin, percentage to total mass

	Protein							
Samples	Total (T)	Water-soluble	Salt-soluble	Alkali-soluble	Water	Fat (F)	Ash	Proportion F:T
Poultry skin	18.30	3.10	4.65	10.59	66.55	10.96	4.70	0.59

determination of a mass fraction of fat was determined in accordance with State Standard 23042-85; determination of a mass fraction of protein was determined by a mineralization by Kjeldahl method State Standard 25011-81; the mass fraction of ashes was determined by ashing. Test conditions: a temperature 200°C, moisture 60%. Experimental data provided in a Table 1.

RESULTS AND DISCUSSION

Based on the water component, it can be confirmed that the poultry skin is similar to such sub-products as swine tongue and beef tongue (71.2 and 67.9%, respectively), beef head (67.9%) and beef udder (72.6%). Proteins of chicken skin have high number of water-soluble proteins similar to muscle tissue and alkali-soluble component of connective tissue.

Therefore, chicken skin can be considered as a raw material rich with both, bone tissue and muscle tissue. Structural analysis of chicken skin also shows that it can be utilized as a nutritional supplement and protein source. Amino-acid balance includes complete set of amino acids, including all primary ones. Notably, there is a high ratio of glutaminic and asparagenic acids which are known for creating a specific taste (Table 2).

Comparing to the meat chicken skin has less amino acid in total and primary amino acids specifically by 30 and 50%, respectively. Analysis of fat and acidic components, especially identification of polyunsaturated fat acids, plays a key role in assessment of nutritional value of the product. Qualitative and quantitative profile of fatty acids is shown on gas chromatograph GS-14B Shimadzu. Comparative analysis of fat acids is reflected in Table 3.

Polyunsaturated acids are considered to be primary nutritional components, containing active vitamins and supporting many functions in human body, including creation of cellular membranes.

Analysis of digestibility shows that it is similar to well-know collagen-containing after products and could be listed in descending order as following: poultry stomach>comb>feet>skin>intestines. Caloric value is also worth of consideration (J/100 g of product) stomach 578.08; comb 650.50; feet 668.07; skin 750.98; intestines 488.91. McCance and Widdows ons's reference data also confirms that in terms of caloric value poultry skin exceeds all other after products of poultry processing due to high number of lipids (Table 4).

Therefore, the histomorphologic and chemical analysis of chicken skin, confirms feasibility of its use as a source of proteins and easily digestible fats in the development of various protein supplements for food products. At present a team of researchers from Shakarim State University of Semey developed food emulsion on the basis of chicken skin.

Table 2: Amino-acid structure of chicken skin, grams for 100 g of protein

Amino acids 1	Poultry skin 2
Primary	
valine	1.472
Isoleucine	1.989
Leucine	3.285
Lysin	3.335
Threonine	2.713
Phenylalanine	2.059
Methionine	0.588
Tryptophane	-
Total	15.441
Dispensable and semidispensable	
Alanine	7.524
Arginine	4.183
Aspartic	6.006
Histidine	1.166
Glycine	5.887
Glutamic	5.607
Proline	4.402
Serine	2.548
Tyrosine	1.728
Histidine	0.142

Table 3: Fatty acid profle of chicken skin and poultry meat

	Acid component, percentage to total	
Fatty acids	Poultry skin	Meat
Myristic	0.94	0.10
Palmitic	30.67	26.00
Palmitoleic acid	8.09	-
Stearic	5.00	6.00
Oleic	38.12	40.00
Linoleic	14.08	21.00
Linolenic	0.42	-
Other fatty acids	2.68	9.30

Table 4: McCance and widdow sons's reference data

Sample	Description and source	Edible part-ratio	Water (g)	Nitrogen (g)	Protein (g)	Fat (g)	Carbohydrates (g)	Caloric value		Fatty acids (g)			
								cal	kJ	Saturated	Mono unsaturated	Poly unsaturated	Hydrogenated fats
1	2	3	4.0	5.00	6.0	7	8.0	9	10	11.00	12.00	13.00	14.00
Chicken dry, fried and grilled	34 samples crispy fried	1.00	31.1	3.45	21.5	46	10.0	501	2070	12.90	22.50	7.70	0.60

CONCLUSION

In the field of rational use of low-value products of meat processing there are already developed and successfully introduced in production different types of food stuff as well as its constituent components, received from above-mentioned collagen-containing sub-products of the meat industry. Among them there are: sets for jellies, sub-food forcemeats, sausages, meat bread, various proteinaceous additives, additives, emulsions, stabilizers and other. Carried out tests speak about expediency of use of some secondary product of meat processing, in particular of chicken skin in meat production. Data of the determined chemical composition allow drawing a conclusion on sufficient nutritional value of the chosen research objects and it gives us the chance to use chosen low-value collagen-containing products of poultry in production of new meat products.

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